بسم الله الرحمن الرحيم

Week No.	Section	Topics	Problems
1	1.9	Vectors	(Example 1.12, Page 20) + Tutorial Problems
	1.10	Components of Vector	

TEXTBOOK:
College Physics, 11edition By Raymond A. Serway, Chris Vuille, CENGAGE, 2018,
ISBN: 978-1-337-62033-8

المتجهات
Vectors

قياسية
Scaler

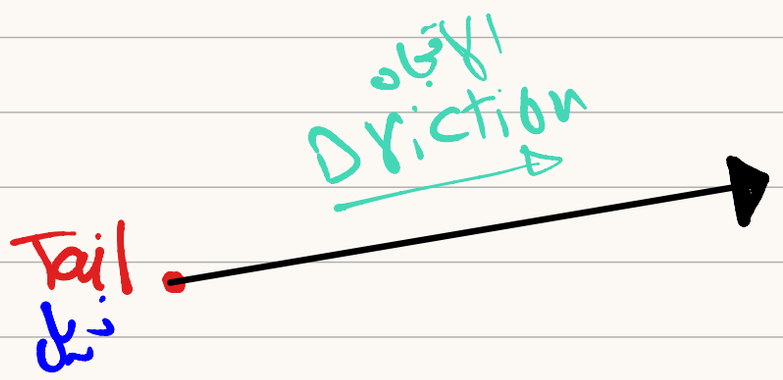
- magnetude only
مقدارها فقط

EX: mass
Temp

متجهة
Vector

- magnetude
- Direction
المقدار والاتجاه

EX: Focre ⇄ ⇅
velocity



1.9 Vectors المتجهات

قياسي

- **Scalar quantity,** can be completely described by a single number (with appropriate units) giving its magnitude or size. مقدار

e.g., mass, temperature, volume, and speed.

الكتلة درجة الحرارة الحجم السرعة القياسية

اتجاهي

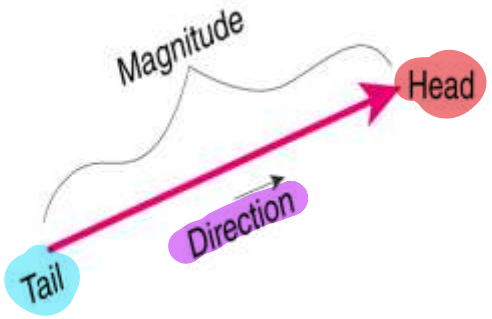
- **Vector quantity,** has both a magnitude and a direction. مقدار و اتجاه

e.g., velocity, acceleration and force

سرعة متجهة التعجيل القوة

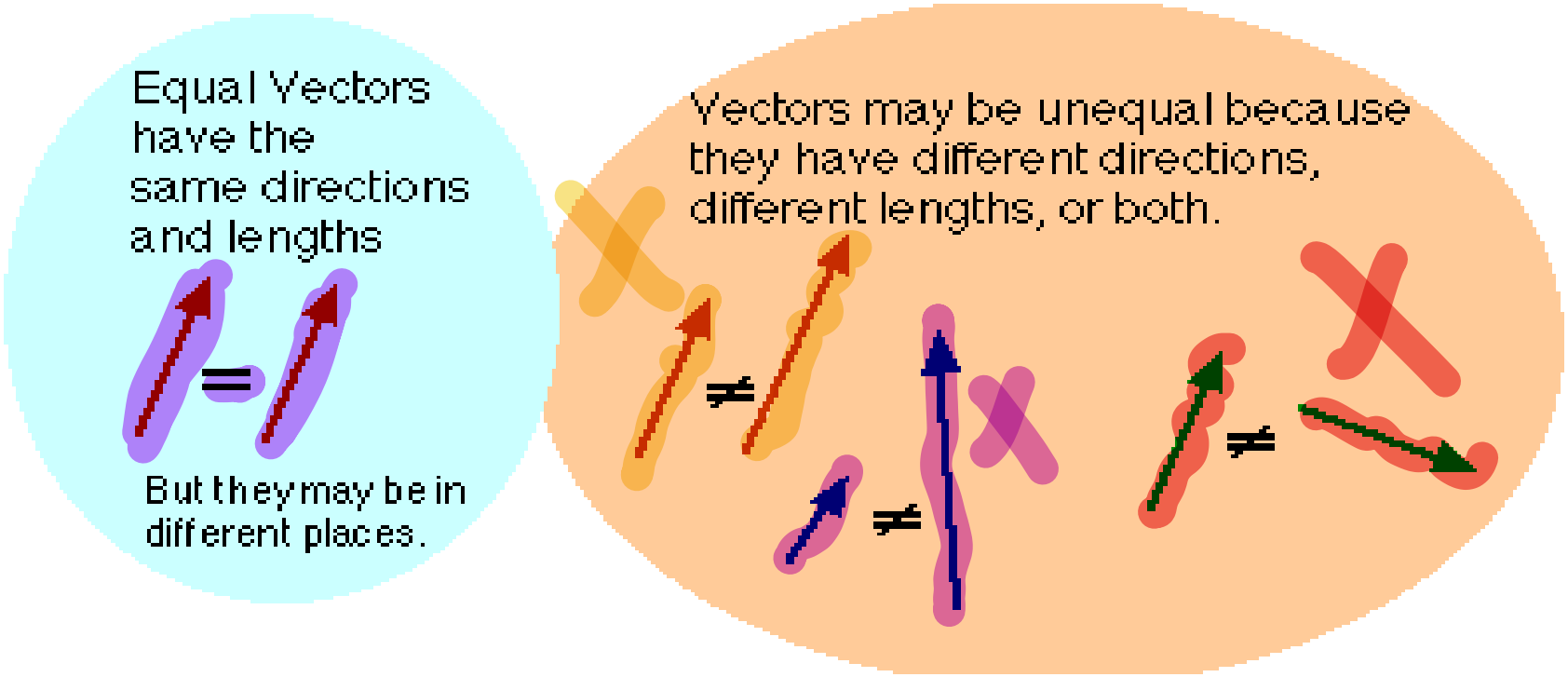
Representation of vectors:

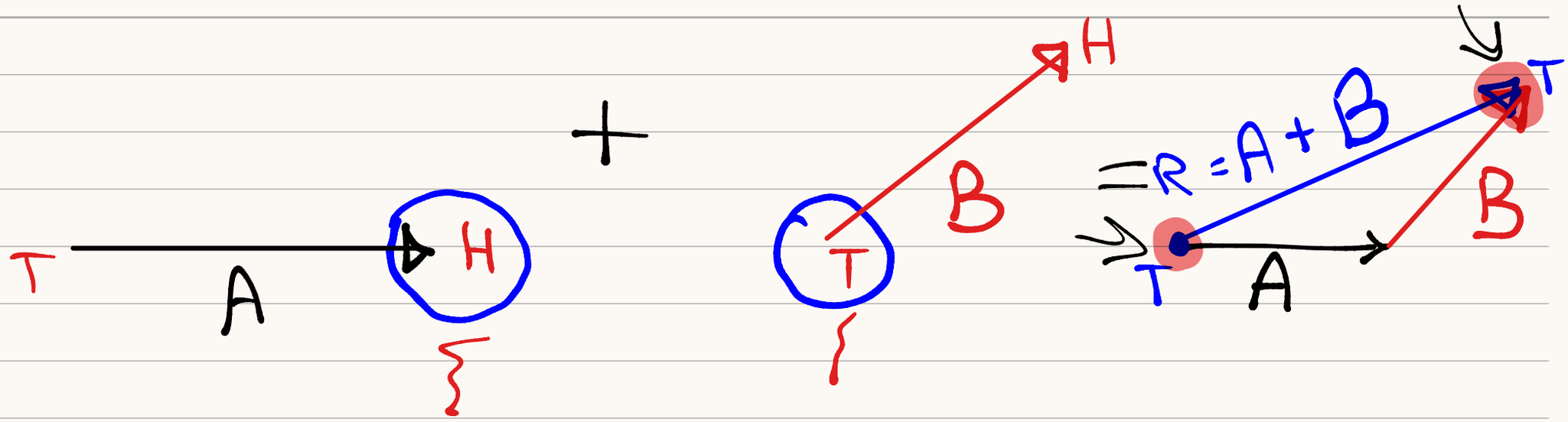
- A vector quantity is often represented with bold face type with an arrow over the letter($\vec{A}$)
- The magnitude of the vector will be represented by italic type, as *A*.
- Italic type will also be used to represent scalars



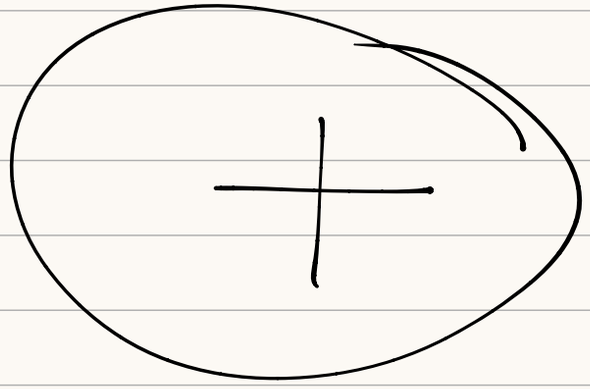
1.9.1 Equality of Two Vectors

- *Two vectors are equal if they have the same magnitude and the same direction.*
- Any vector can be moved parallel to itself without being affected.



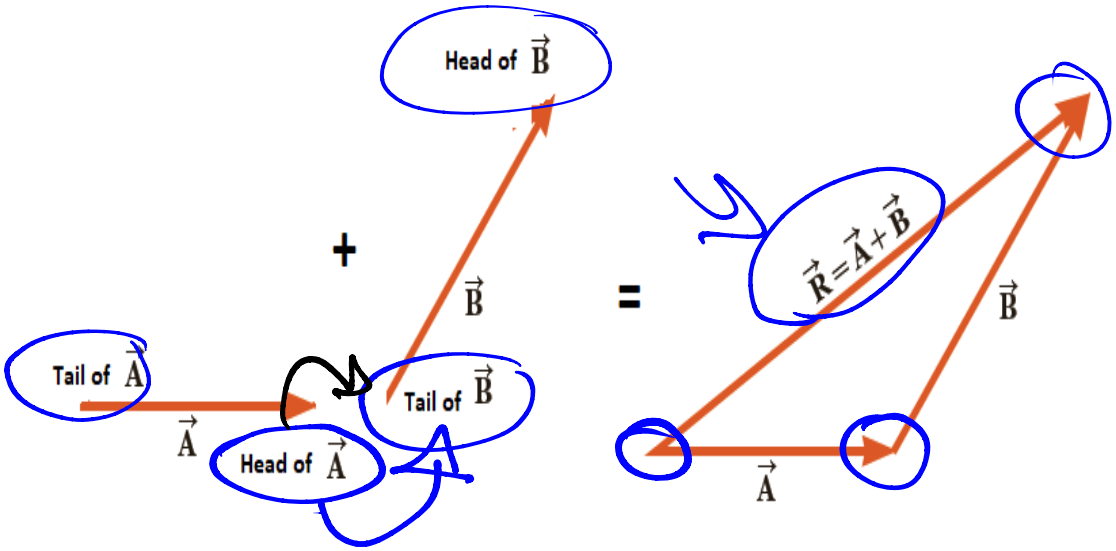


Reslutant vector $\rightsquigarrow R = A + B = B + A$



1.9.2 Adding Vectors

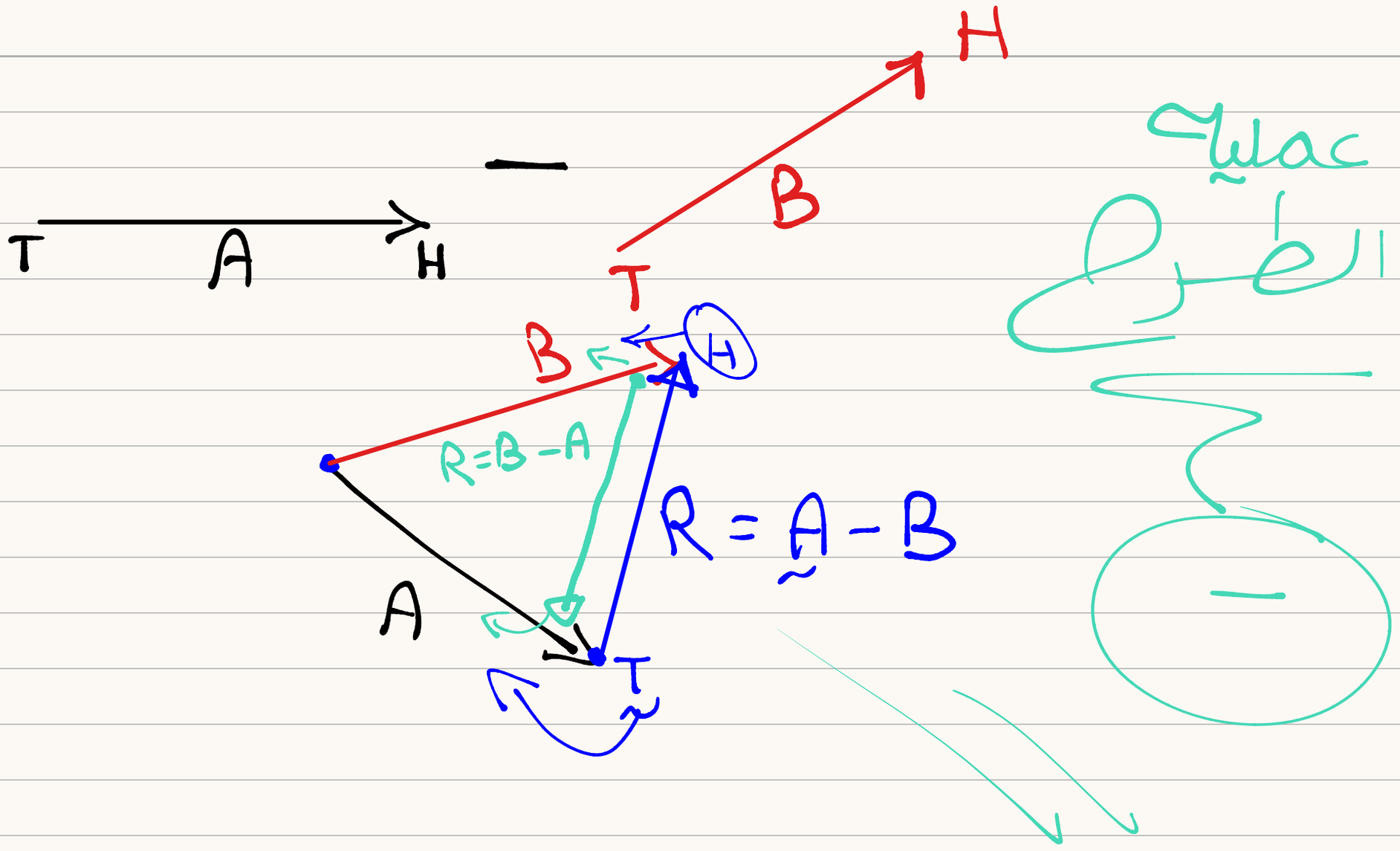
- Draw the first vector ($\vec{A}$), then place the tail of the second vector ($\vec{B}$) at the head of the first.
- Finally draw the resultant ($\vec{R} = \vec{A} + \vec{B}$) from the tail of $\vec{A}$ to the head of $\vec{B}$ to complete the triangle



➢ *This procedure is known as the **triangle method of addition.***

➢ When two vectors are added, their sum is independent of the order of the addition: $\vec{A} + \vec{B} = \vec{B} + \vec{A}$ is called the **commutative law of addition.**

عملية ابدالية

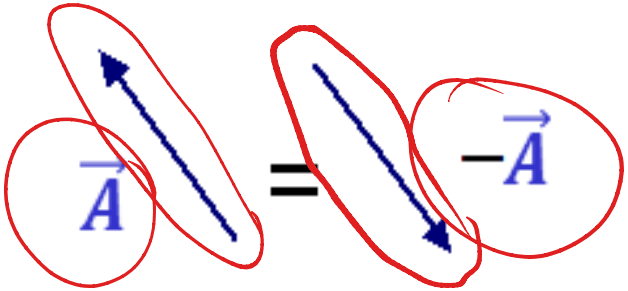


1.9.3 Negative of a vector:

نفس المقدار

A vector with the ***same magnitude*** *(length) but pointing in the exact* ***opposite direction***

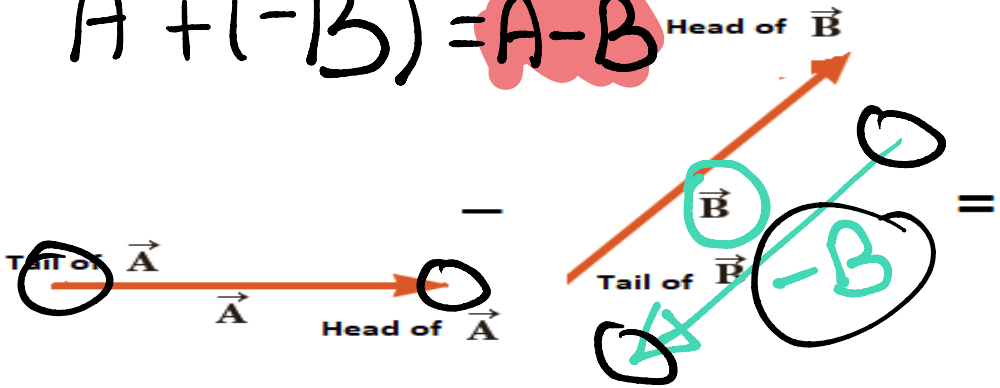
عكس الاتجاه

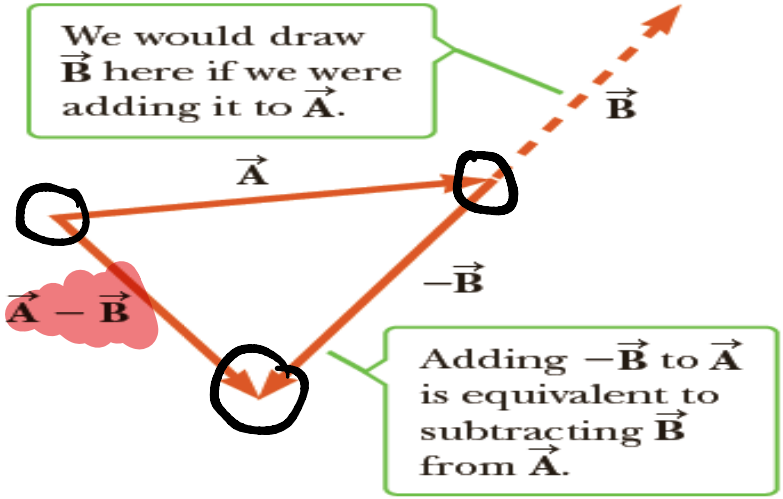


1.9.4 subtracting Vectors

- *Vector subtraction makes use of the definition of the negative of a vector.*
- The operation $\vec{A} - \vec{B} = \vec{A} + (-\vec{B})$ is the vector $-\vec{B}$ added to the vector $\vec{A}$

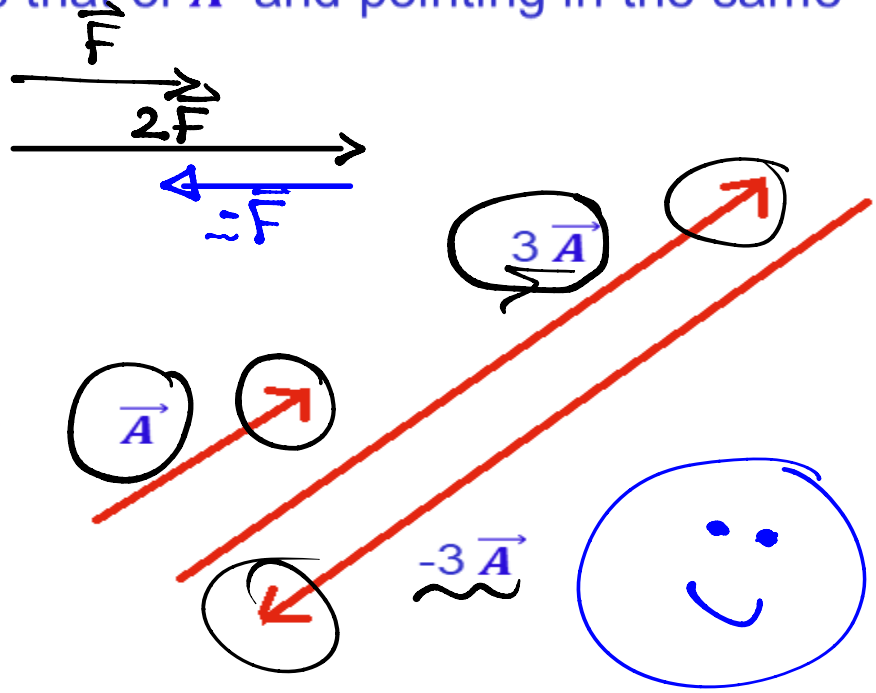
$A + (-B) = A - B$



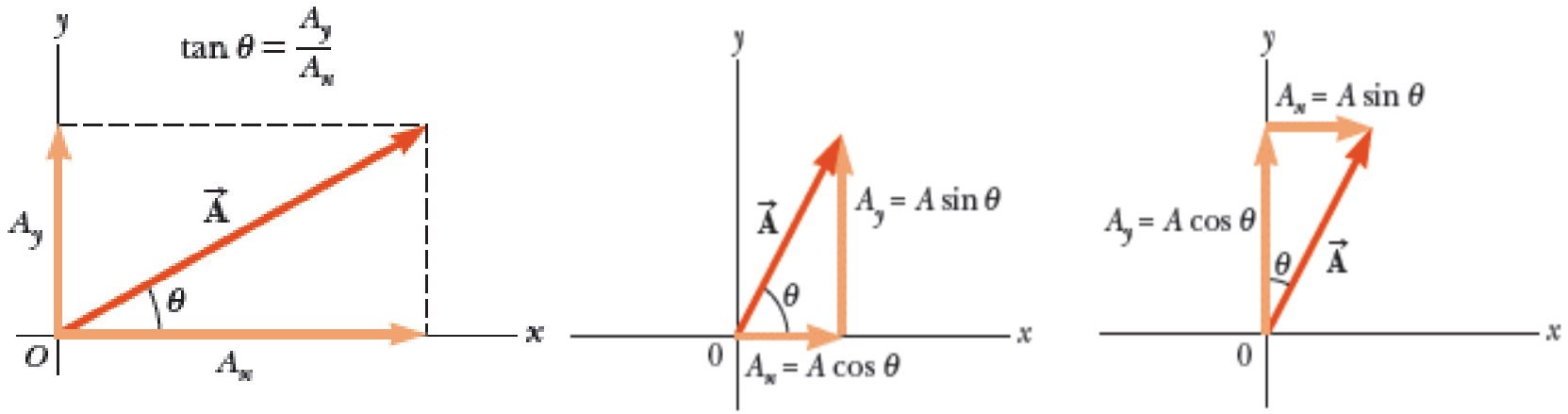


1.9.5 Multiplying or dividing a Vector by a scalar

- Multiplying or dividing a vector by a scalar gives a vector.
- If vector $\vec{A}$ is multiplied by the scalar number 3, the result, written $3\vec{A}$ is a vector with a magnitude three times that of $\vec{A}$ and pointing in the same direction.
- If we multiply vector $\vec{A}$ by the scalar -3, the result is $-3\vec{A}$, a vector with a magnitude three times that of and pointing in the opposite direction (because of the negative sign).



1.10 Components of a Vector



- To add vectors makes use of the projections of a vector along the axes.
- These projections are called components.

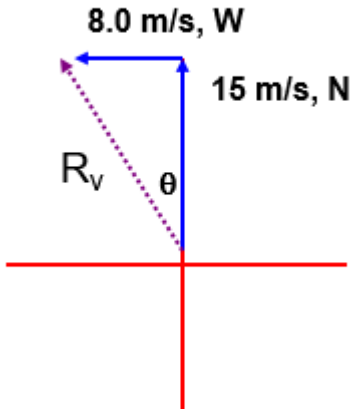
$$A_x = A\cos\theta$$
$$A_y = A\sin\theta$$

From Fig. we have,

Also we have, $\vec{A} = \vec{A}x + \vec{A}y$

$$A = \sqrt{A_x^2 + A_y^2} \qquad \tan\theta = \frac{A_y}{A_x} \qquad \theta = \tan^{-1}\left(\frac{A_y}{A_x}\right)$$

Example: A boat moves with a velocity of 15 m/s, N in a river which flows with a velocity of 8.0 m/s, west. Calculate the boat's resultant velocity with respect to due north.



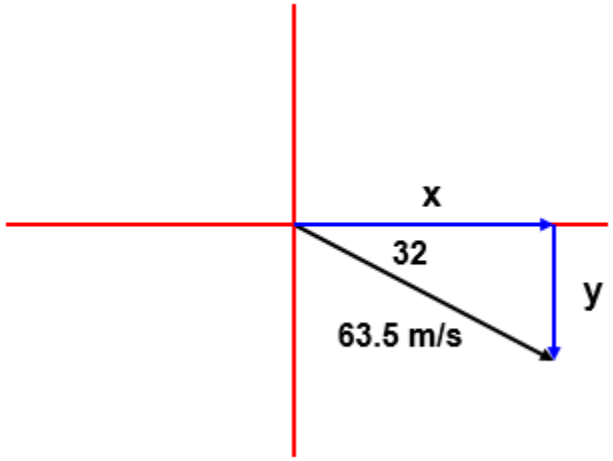
$$R_v = \sqrt{8^2 + 15^2} = 17\,m/s$$

$$Tan\theta = \frac{8}{15} = 0.5333$$

$$\theta = Tan^{-1}(0.5333) = 28.1^\circ$$

The Final Answer : **17 m/s, @ 28.1 degrees West of North**

Example : A plane moves with a velocity of 63.5 m/s at 32 degrees South of East. Calculate the plane's horizontal and vertical velocity components.



$$A_x = A\cos\theta$$

$$= (63.5)\cos 32$$

$$= 53.85 \text{ m/s , east}$$

$$A_y = A\sin\theta$$

$$= (63.5)\sin 32$$

$$= 33.64 \text{ m/s , south}$$